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Book of Abstracts

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Cosmology / **310**

21 cm Cosmology

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Parallel Session BSM+DM / **366**

A 96 GeV Higgs Boson in the N2HDM

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We discuss a ~ 3 σ signal (local) in the light Higgs-boson search in the diphoton decay mode at ~ 96 GeV as reported by CMS, together with a ~ 2 σ excess (local) in the b¯b final state at LEP in the same mass range. We interpret this possible signal as a Higgs boson in the 2 Higgs Doublet Model with an additional real Higgs singlet (N2HDM). We find that the lightest Higgs boson of the N2HDM can perfectly fit both excesses simultaneously, while the second lightest state is in full agreement with the Higgs-boson measurements at 125 GeV, and the full Higgs-boson sector is in agreement with all Higgs exclusion bounds from LEP, the Tevatron and the LHC as well as other theoretical and experimental constraints. We show that only the N2HDM type II and IV can fit both the LEP excess and the CMS excess with a large ggF production component at ~ 96 GeV. We derive bounds on the N2HDM Higgs sector from a fit to both excesses and describe how this signal can be further analyzed at the LHC and at future e+e− colliders, such as the ILC.

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EW+Top+Higgs

Parallel Session Higgs+Top+EW / **420**

ATLAS-specific talk (TBC)

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353

BAO measurement based on Lya forests

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Just after inflation, due to the coupling between photons and baryons, sound waves were created and propagated in the primordial plasma until recombination. At that time, these so called Baryonic Acoustic Oscillations (BAO) left their imprint in the matter distribution. This feature is still measurable as a small excess (1%) in the matter 2-point correlation function.
This BAO peak can be measured both transversely and radially. The transverse measurement yields the ratio of the angular-diameter distance to the sound horizon scale at recombination (da(z)/rs), while the radial measurement gives access directly to the expansion rate through the quantity H(z)rs.
First detected in the Luminous red galaxy correlation function at redshifts between 0.16 and 0.47 (Einseinstein et al., 2005 and Cole et al., 2005), other matter tracers have since be used to access to other redshift ranges. The highest redshift measurement has been performed at z = 2.34, using the Lya forests seen in high redshift quasar spectra.
I will present the latest BAO measurement based on Lya forests at mean redshift 2.34 using the SDSS-IV – eBOSS data. This analysis yields 3.3 % and 4.4 % precision on the measurements of the H(z)rs and Da(z)/rs respectively.

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Astro/Cosmo

Parallel Session Astro+Cosmo / 362

BICEP/Keck

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Parallel Session QCD+HF / 387

Belle II status and early physics

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Parallel Session Higgs+Top+EW / 416

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Parallel Session BSM+DM / 449

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Parallel Session Higgs+Top+EW / 421

CMS-specific talk (TBC)

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Parallel Session BSM+DM / 370

COSINE-100 dark matter experiment

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The COSINE experiment aims at direct detection of Weakly Interacting Massive Particle (WIMP) using NaI(Tl) detectors, the same target material as the DAMA/LIBRA which claims to observe an annually modulated WIMP signal. The first phase of the experiment with ~106 kg of NaI(Tl) crystals consists of several shield structures including a liquid scintillator veto counter and installed at the Yangyang underground laboratory in Korea. The experiment started physics data taking in late September 2016 and several WIMP search analyses have been performed based on the 2 keV energy threshold with about 3 counts/day/kg/keV background rate in a region between 2 and 6 keV. In this talk, recent results and the prospect of the COSINE-100 experiment will be presented.

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Astro/Cosmo

Heavy Flavour Physics / **316**

CP violation

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Neutrino Physics / **321**

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Summary Talk / **300**

Conference Summary

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The High Energy Universe / **307**

Cosmic Rays

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Parallel Session Astro+Cosmo / 378

Cosmic Tau Neutrinos and the Astrophysical Neutrino Flavor Composition

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The IceCube Neutrino Observatory at the South Pole, which detects Cherenkov light from charged particles produced in neutrino interactions, firmly established the existence of an astrophysical high-energy neutrino component. The study of astrophysical neutrinos provides important clues about cosmic particle accelerators. In particular, the tau neutrino fraction on Earth is directly translatable to the source flavor composition and can constrain source production mechanisms. Due to the very prompt decay of the heavy tau lepton most tau neutrino interactions cannot be distinguished from other flavor neutrino interactions, thus leading to the tau neutrino fraction being largely unconstrained. However, in IceCube, ν_τ -CC interactions above ~ 100 TeV can produce resolvable double cascades, breaking the degeneracy between ν_e and ν_τ present at lower energies. Here I present the measurement of the flavor composition performed on IceCube's High-Energy Starting Event sample with a livetime of about 7.5 years. I will present IceCube's first two identified double cascades and discuss the properties of the two ν_τ candidates.

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Parallel Session Astro+Cosmo / 347

Cosmic Tau Neutrinos and the Astrophysical Neutrino Flavor Composition

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Parallel Session Astro+Cosmo / 342

Cosmology with Weak Lensing

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Parallel Session BSM+DM / 355

DARWIN: the ultimate dark matter detector

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The DARWIN experiment is a proposed next-generation dual-phase time projection chamber which will operate 50 tonnes of natural xenon and whose primary goal will be to explore the entire experimentally accessible parameter space for WIMPs. Besides its unprecedented sensitivity to WIMPS above a mass of 5 GeV/c2, such a large detector, with its low-energy threshold and ultra low background level, will be sensitive to other rare interactions as well. DARWIN will measure low energy solar neutrinos with a high precision, observe the coherent neutrino-nucleus interaction and detect galactic supernovae. In addition it will search for axions, axion-like particles and the neutrinoless double beta decay of 136Xe. We discuss here the concept of DARWIN, the ongoing R&D and the sensitivity for the different physics channels.

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DARWIN: the ultimate dark matter detector **Subject**:

Astro/Cosmo

Cosmology / **311**

Dark Energy Survey

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Cosmology / **312**

Dark Energy: Theoretical Developments

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Parallel Session BSM+DM / **445**

Dark matter and the 21cm global signal at cosmic dawn

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Parallel Session QCD+HF / **391**

Dark matter searches at Belle II

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QCD+EW+Top Physics+Heavy Ions / 334

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Parallel Session Higgs+Top+EW / 426

Di-Higgs searches at 13 TeV and prospects for HL-LHC in ATLAS

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Parallel Session Higgs+Top+EW / 432

Differential cross-section measurements for ttbar and ttbar+bb production in ATLAS

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Subject:

Parallel Session BSM+DM / 335

Directional Dark Matter Search with Nuclear Emulsion

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The NEWSdm experiment, based on nuclear emulsions, is proposed to measure the direction of WIMP-induced nuclear recoils. We discuss the potentiality, both in terms of exclusion limits and potential discovery, of a directional experiment based on the use of a solid target made by newly developed nuclear emulsions and read-out systems reaching sub-micrometric resolution. We also report results of the test exposure conducted in Gran Sasso last year.

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Directional Dark Matter Search with Nuclear Emulsion **Subject**:

BSM+DM

Discussion Session / **306**

Discussion

Parallel Session Astro+Cosmo / **346**

EBL and Star Formation History from Fermi Data

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Parallel Session Neutrinos / **412**

Earth tomography with neutrinos

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Parallel Session Neutrinos / **345**

Electromagnetic neutrinos: New constraints and new effects in oscillations

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Abstract:

We have continued discussions of neutrino electromagnetic properties [1,2] and have performed a detailed and accurate study [3] of the electromagnetic interactions of massive neutrinos in the theoretical formulation of low-energy elastic neutrino-electron scattering.
Using the derived new expression for a neutrino electromagnetic scattering cross section [3], we obtained [4] a new bound on the neutrino charge radii from COHERENT elastic neutrino-nucleus scattering data. Worthy of note, our paper [4] has been included by the Editors Suggestion to the Phys.Rev.D "Highlights of 2018".
A reasonable part of the proposed talk is dedicated to results of our recently performed detailed studies of new effects in neutrino spin, spin-flavour and flavor oscillations under the influence of the transversal matter currents [5] and a constant magnetic field [6]. These two effects can be summarized as follows:

1) it is shown [5] that neutrino spin and spin-flavor oscillations can be engendered by weak interactions of neutrinos with the medium in the case when there are the transversal matter currents (for the appearance of neutrino spin oscillations in this case there is no need either for a neutrino nonzero magnetic moment or for an external magnetic field); different possibilities for the resonance amplification of oscillations are discussed, the neutrino Standard Model and non-standard interactions are accounted for;

2) within a new treatment [6] of the neutrino flavor, spin and spin-flavour oscillations in the presence of a constant magnetic field, that is based on the use of the exact neutrino stationary states in the magnetic field, it is shown that there is an interplay of neutrino oscillations on different frequencies; in particular: a) the amplitude of the flavour oscillations $\nu Le \leftrightarrow \nu L\mu$ at the vacuum frequency is modulated by the magnetic field frequency, and b) the neutrino spin oscillation probability (without change of the neutrino flavour) exhibits the dependence on the neutrino mass square difference $\Delta m2$.

The discovered new phenomena in neutrino oscillations should be accounted for reinterpretation of results of already performed experiments on detection of astrophysical neutrino fluxes produced in astrophysical environments with strong magnetic fields and dense matter. These new neutrino oscillation phenomena are also of interest [7,8] in view of future experiments on observations of supernova neutrino fluxes with large liquid-scintillator detectors like JUNO, for instance.

References:

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Electromagnetic neutrinos in laboratory experiments and astrophysics,

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[8] J.S. Lu, Y.-F. Li and S. Zhou,
Getting the most from the detection of Galactic supernova neutrinos in future large liquid-scintillator detectors, Phys. Rev. D 94 (2016) 023006.

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Neutrinos

Parallel Session Higgs+Top+EW / 422

Electroweak corrections in Higgs physics

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Parallel Session Higgs+Top+EW / 377

Equivalent photons in proton-proton and ion-ion collisions at the LHC

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The LHC can be considered as a photon-photon collider with photons produced in ultraperipheral collisions of charged particles. Ultraperipheral collision is a kind of collision when the colliding particles pass at large distance from each other and collide with their electromagnetic fields. The particles remain intact after the collision. Electromagnetic field of an ultrarelativistic particle can be represented as a bunch of almost real (equivalent) photons distributed according to a known spectrum. Thus, ultraperipheral collisions at the LHC are a rich source of events to study $\gamma\gamma \to$ something reactions.

Photon flux in an ultraperipheral collision is proportional to $(Z_1 Z_2)^2$ where Z_1 and Z_2 are charges of the colliding particles. In this respect collisions of lead ions with $Z = 82$ look very promising for the search of New Physics in photon-photon collisions even though the *pp* luminosity is a lot higher. However, the invariant mass of the produced system is limited by the maximum momentum of a virtual photon that the colliding particle can interact with in its reference frame without breaking apart. For the protons colliding with the energy of 13 TeV, the invariant mass can reach 2.8 TeV,

while in the case of lead-lead collision with the energy of 5.02 TeV/(nucleon pair) production cross section falls rapidly after 100 GeV.

Production cross section of ultraperipheral collisions is very sensitive to electromagnetic form factors of the colliding particles. The data for ^{208}Pb available in the literature is somewhat controversial. Nevertheless, the calculated production cross section for a pair of muons closely follows the experimental points. Production of muons in proton-proton collisions is described within the experimental uncertainty.

Ultraperipheral collisions at the LHC can be used to improve limits on supersymmetry in the region where chargino and neutralino masses are nearly equal. Final state protons can be registered by the forward detectors (ATLAS Forward Proton Detector or CMS-TOTEM Precision Spectrometer), and momenta of charginos produced in the collision are known. This information is used to greatly reduce the background from the Standard Model processes.

The talk is mostly based on the paper arXiv:1806.07238.

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Equivalent photons in proton-proton and ion-ion collisions at the LHC **Subject**:

EW+Top+Higgs

Beyond the Standard Model / Dark Matter / 338

Exploring BSM at low energy

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Parallel Session BSM+DM / 372

First Results from the ABRACADABRA-10 cm Prototype

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The evidence for the existence of Dark Matter is well supported by many cosmological observations. Separately, long standing problems within the Standard Model point to new weakly interacting particles to help explain away unnatural fine-tunings. The axion was originally proposed to explain the Strong-CP problem, but was subsequently shown to be a strong candidate for explaining the Dark Matter abundance of the Universe. ABRACADABRA is a proposed experiment to search for ultralight axion Dark Matter, with a focus on the mass range $10^{-14} < m_a < 10^{-6}$ eV. We search for

these axions and other axion like particles (ALPs) through a modification to Maxwell's equations, which cause strong magnetic fields to source weak oscillating electrical currents parallel to the field. In this talk, I will describe the working principle behind the ABRACADABRA experiment, present the first results from a prototype experiment called ABRACADABRA-10 cm that we have built at MIT, and discuss prospects for future versions of ABRACADABRA.

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First Results from the ABRACADABRA-10 cm Prototype **Subject**:

BSM+DM

Parallel Session BSM+DM / **356**

First results of ANAIS-112 on dark matter annual modulation

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ANAIS (annual modulation with NaI Scintillators) is a dark matter direct detection experiment located at the Canfranc Underground Laboratory (LSC, Spain). Its main goal is to proof or refute in a model independent way the DAMA/LIBRA positive result: an annual modulation in the low-energy detection rate compatible with the expected signal induced by WIMPs in the galactic halo. This signal, observed during more than 20 years, is in strong tension with the negative results of other very sensitive experiments, but a direct comparison using the same target material (NaI(Tl)) is still lacking. ANAIS-112, consisting of 112.5 kg of NaI(Tl) scintillators, was installed at the LSC in August 2017 and to the date it has accumulated more than 1.5 y of data. In this talk we will present the annual modulation analysis corresponding to an exposure of 157.55 kgxy and the ANAIS-112 projected sensitivity for the scheduled 5 y of operation.

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First results of ANAIS-112 on dark matter annual modulation **Subject**:

BSM+DM

Discussion Session / **304**

Future Electron Positron Colliders

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Discussion Session / **305**

Future Hadron Colliders

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The High Energy Universe / **308**

Gamma Ray Astrophysics

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Parallel Session BSM+DM / **448**

General bounds on Conformal Dark Sectors

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I present the most general bounds one can make on the phenomenology of hidden sectors with conformal symmetry, which are weakly coupled to the SM. Without the need to specify their particle or symmetry content, we have derived a consistent description of final states in a generic CFT, and have applied it to current experimental runs. Our analysis covers a wide range of phenomena: we investigate collider searches (LEP, LHC run 2), a number of low-energy experiments, and effects on cosmology and astrophysical objects. The combined results form a guide to model building with conformal sectors.

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Parallel Session Astro+Cosmo / **351**

H0liCOW: Hubble constant measurements

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Parallel Session Astro+Cosmo / **341**

HAWC: Results and Prospects

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Parallel Session QCD+HF / 396

Hadron spectroscopy and exotic states at LHCb

Parallel Session QCD+HF / 395

Hadron spectroscopy at BESIII

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Parallel Session QCD+HF / 385

Heavy Flavour Results from the Tevatron

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QCD+EW+Top Physics+Heavy Ions / 333

Heavy Ion Theory

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Parallel Session QCD+HF / 386

Heavy flavour production and properties in ATLAS and CMS

Parallel Session QCD+HF / 403

Heavy-ion measurements in ATLAS

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Abstract Title:

Subject:

Parallel Session QCD+HF / 406

Heavy-ion measurements in CMS

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The Higgs Boson / 323

Higgs Couplings and Properties

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The Higgs Boson / 330

Higgs and Cosmology

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Parallel Session QCD+HF / 401

Higgs boson pair and H+jet production

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Parallel Session Higgs+Top+EW / 425

Higgs-boson measurements in ttH production in ATLAS

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Parallel Session Higgs+Top+EW / 424

Higgs-boson properties in CMS

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Parallel Session Higgs+Top+EW / 423

Higgs-boson transverse momentum

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Subject:

Parallel Session QCD+HF / 404

Highlights from heavy-flavor measurements with ALICE in heavy-ion collision

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Abstract Title:

Subject:

Parallel Session Astro+Cosmo / **381**

Highlights from the VERITAS Radio Galaxy Observation Program

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The VERITAS observatory is a ground-based air Cherenkov telescope array that detects very-high-energy gamma-ray emission (VHE;>100 GeV) from a range of astrophysical sources including nearly 40 Active Galactic Nuclei (AGN). The vast majority of these AGN are blazars where relativistic plasma jets aligned within a few degrees to our line of sight cause the observed radiation to be highly Doppler boosted. Radio galaxies are AGN with jets viewed at systematically larger angles to the line of sight, making these objects more challenging to detect in VHE gamma rays. Nevertheless, a few radio galaxies are detected in the VHE including M 87 and Centaurus A, opening a new angle into investigating non-thermal processes in large-scale structures of AGN. To gain further insights, the VERITAS Collaboration has carried out an effort over the past several years to monitor known sources as well as detect additional examples of radio galaxies. This presentation will highlight several of our recent results including the analysis of the NGC 1275 flares detected by VERITAS in October 2016 and January 2017 as well as the discovery in March 2018 of 3C 264, the most distant radio galaxy yet detected in VHE.

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Highlights from the VERITAS Radio Galaxy Observation Program **Subject**:

Astro/Cosmo

Parallel Session Astro+Cosmo / **383**

Highlights from the VERITAS Radio Galaxy Observation Program

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Beyond the Standard Model / Dark Matter / **325**

Highlights on SUSY and Exotic Searches

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Parallel Session Higgs+Top+EW / 413

Inclusive multi-boson measurements in ATLAS and CMS

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Abstract Title:

Subject:

Parallel Session Neutrinos / 357

KM3NeT-ORCA: Oscillation Research with Cosmics in the Abyss

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KM3NeT is a distributed research infrastructure in the Mediterranean Sea that will host a gigaton-scale neutrino telescope (ARCA) for high-energy neutrino astronomy, and a megaton-scale detector (ORCA) for neutrino oscillation studies with atmospheric neutrinos. ORCA is optimised for determining the neutrino mass ordering (NMO) by observing matter effects in atmospheric neutrino oscillations, providing a sensitivity to the NMO of approximately 3σ after 3 years of operation with the full detector. It will also measure the atmospheric mixing parameters Δm232 and θ23 using both the muon neutrino disappearance and tau neutrino appearance channels. Determining the tau neutrino appearance probability with unprecedented precision will provide for a powerful test of the unitarity of the 3-flavour mixing matrix. The observation of neutrino oscillations over a wide range of baselines and energies will provide broad sensitivity to new physics such as non-standard neutrino interactions (NSI) and sterile neutrinos.

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KM3NeT-ORCA: Oscillation Research with Cosmics in the Abyss **Subject**:

Neutrinos

Parallel Session Astro+Cosmo / 380

Latest Results from the ANTARES Neutrino Telescope and Prospects for KM3NeT-ARCA

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The search for astrophysical neutrinos in the TeV-PeV range is among the primary goals of underwater neutrino telescopes like ANTARES and KM3NeT. The first significant evidence of a cosmic diffuse flux of high-energy neutrinos together with the first identification of a neutrino source, TXS 0506+056, reported by the IceCube collaboration, represented a crucial step forward in the field of neutrino astronomy. ANTARES, located in the Northern hemisphere, with an excellent visibility of the Galactic Plane, and with a very good angular resolution, is well suited to set already valuable constraints on the origin of the cosmic IceCube flux. The future KM3NeT telescope, and in particular its high-energy component, KM3NeT-ARCA, currently being deployed in the Mediterranean Sea, will combine a cubic kilometre-sized detector with the same high visibility towards the Galactic Centre as ANTARES. It is expected to detect the neutrino flux reported by IceCube and it will be able to make definite statements about a neutrino flux from several Galactic candidates. Here, the latest results of the ANTARES neutrino telescope are presented, focusing on searches for neutrinos from diffuse fluxes, point-like sources, dark matter together with multi-messenger analyses. Moreover, the expected performances of the future high-energy neutrino detector, KM3NeT-ARCA, are discussed.

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Latest Results from the ANTARES Neutrino Telescope and Prospects for KM3NeT-ARCA **Subject**:

Neutrinos

Parallel Session QCD+HF / 393

Latest results from NA48/2

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Subject:

Parallel Session BSM+DM / 360

Latest results from the Xenon1T Dark Matter Experiment, and future prospects

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Observations at astronomical and cosmological levels suggest the existence of a new form of non-luminous matter that interacts gravitationally with baryonic matter. The XENON1T detector, located at the underground National Laboratory of Gran Sasso in Italy, was designed and built to detect nuclear recoils from particles that may constitute the nature of this Dark Matter, their existence emerging in theories beyond the Standard Model under the generic name of Weakly Interacting Massive Particles (WIMPs). Using a 2t of ultra-pure liquid Xenon as target mass, this double phased TPC which was operational from late 2016 to 2018, after a 1 t $\times$ yr exposure, exhibiting an ultra-low electronic recoil background, did not observed a significant excess of the number of events over the expected background, thus achieving to provide the most stringent limit, to date, on the WIMP-nucleon spin-independent elastic scattering cross-section for WIMP masses above 6 GeV/c^2.
In this talk I will present an overview of the XENON1T experiment, its latest results, as well as the prospects for its immediate upgrading, the XENONnT detector that is expected to increase the sensitivity by more than one order of magnitude.

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Latest results from the Xenon1T Dark Matter Experiment, and future prospects **Subject**:

BSM+DM

Parallel Session QCD+HF / 390

Lepton Flavour Universality tests with heavy flavour decays at LHCb

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Parallel Session QCD+HF / 373

Light meson spectroscopy at BESIII

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The BESIII experiment runs in the tau-charm mass region and has collected the world's largest samples of J/ψ events, which is an ideal laboratory to study light hadron spectroscopy and search for exotic hadrons. In this talk, recent BESIII progresses in this field are presented.

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Light meson spectroscopy at BESIII **Subject**:

QCD+Flavour

Parallel Session Neutrinos / **374**

Lithium molybdate scintillating bolometers for double beta decay

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The LUMINEU project has recently set up a technology for the development of high-performance scintillating bolometers containing the nuclide 100Mo, in the framework of the R&D activities towards the proposed tonne-scale neutrinoless double beta decay experiment CUPID. Using in particular Li2100MoO4 detectors, high energy resolution (5-6 keV FWHM at 2615 keV), excellent alpha background rejection (>99.9%) and extreme radiopurity (below 0.005 mBq/kg U/Th intrinsic activity) have been demonstrated in multiple tests with remarkable reproducibility. Moreover, with only 0.1 kg x y of 100Mo exposure, the measured two-neutrino double beta decay half-life is one of the most precise values ever reported. As a follow-up of this activity, a demonstrator named CUPID-Mo is collecting data in the Modane underground laboratory in France. CUPID-Mo consists of twenty 0.2-kg 100Mo-enriched Li2MoO4 scintillating bolometers (containing more than 2 kg of 100Mo) to be operated for at least 0.5 yr, providing a sensitivity to 100Mo larger than 10^24yr. CUPID-Mo is a very important demonstrator for the implementation of CUPID, as the CUPID-Mo detectors follow closely the configuration chosen for the baseline of CUPID.

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Lithium molybdate scintillating bolometers for double beta decay **Subject**:

Neutrinos

Parallel Session BSM+DM / **439**

Long Lived Particles

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Subject:

Beyond the Standard Model / Dark Matter / 337

Long lived BSM

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Subject:

Parallel Session QCD+HF / 388

Mixing and CP violation in beauty and charm at LHCb

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Parallel Session BSM+DM / 438

Multi-boson channels

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The High Energy Universe / 309

Multimessenger Astrophysics

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339

Muon collider: the Low EMittance Muon Accelerator (LEMMA) approach

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In order to further consolidate the present knowledge of the Standard Model and to look for deviations from its predictions that would signal new physics effects a new generation of hadron-hadron or electron-position colliders is put forward. However also the idea of a muon collider seems to be attractive because such a machine would provide the high centre of mass energy typical of a hadron-hadron machine in the clean experimental environment typical of an electron-position machine.
Hence the muon collider can serve as a Higgs factory, can explore the multi-TeV frontier and can be used to investigate rare muon processes, including any process related to lepton universality violation in the muon sector.
Clearly the muon collider has to face quite a few challenges. One of these is the production of a low emittance muon (antimuon) beam to be fed into a suitable accelerator complex.
Recently the idea of getting such muons (antimuons) from collisions of an about 45 GeV low emittance positron beam on a fixed target has been put forward. The 45 GeV incident positron energy is chosen because it corresponds to the energy threshold of the process
e+ e- → mu+ mu-
which, at threshold, should give the wanted muon (antimuon) low emittance particles flux.
The experimental proof of this expectation is the goal of the Low EMittance Muon Accelerator (LEMMA) collaboration who carried out in Summer 2017 and Summer 2018 dedicated tests with a 45 GeV positron beam at the CERN H4 (2017) and H2 (2018) experimental areas. These tests were based on a silicon telescope setup complemented by a dipole magnetic field, muon chambers and a set of calorimeters, to tag electrons and positrons.
The ultimate goal of the LEMMA collaboration is the measurement of the emittance of the produced muon (antimuon) particles flux and of the corresponding cross section at threshold.
A description of the muon collider project and of the reaches in terms of physics will be given first.
Then the concepts and the experimental setup used for the 2017 and 2018 emittance test beams will be presented together with a summary of the results reached so far.

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Muon collider: the Low EMittance Muon Accelerator (LEMMA) approach **Subject**:

EW+Top+Higgs

Parallel Session QCD+HF / 451

Muon collider: the Low EMittance Muon Accelerator (LEMMA) approach

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Beyond the Standard Model / Dark Matter / 315

New Directions in Dark Matter

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Parallel Session BSM+DM / 437

New Physics in EW phase transition

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Parallel Session Astro+Cosmo / 359

News from the very-high-energy sky with H.E.S.S.

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Parallel Session BSM+DM / 368

On the sensitivity of direct detection experiments to multi-component dark matter.

Andre Scaffidi[None]

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The Weakly Interacting Massive Particle or 'WIMP' has been a widely studied solution to the dark matter problem. A plausible scenario is that DM is not made up of a single WIMP species, but that it has a multi-component nature. In this talk I give an overview of recently published work in which we studied direct detection signals in the presence of multi-component WIMP-like DM. I will give an overview of the smoking gun signature of two-component dark matter, as well as give a detailed explanation of the statistical methods used to forecast a signal in future generations of direct detection detectors. The two main avenues for forecasting that I will present involve a) discriminating between the one and two-component hypothesis and b) parameter reconstruction. I will also present an example of a minimal extension to the general model independent two-component phase space by introducing constraints from thermal freeze out. To conclude I will show our latest results from a two-component fit to the latest DAMA/LIBRA phase-2 results and discuss the issues and limitations one faces when taking into account corrections from gravitational focusing.

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On the sensitivity of direct detection experiments to multi-component dark matter. **Subject**:

BSM+DM

Parallel Session QCD+HF / 411

Open Charm at BESIII

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Subject:

Parallel Session QCD+HF / 407

PDF constraints from QCD and EW measurements in CMS

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Subject:

Parallel Session QCD+HF / 392

Physics beyond SM with Kaons from NA62

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Parallel Session Higgs+Top+EW / 433

Precise predictions for ttA/tt cross section ratios at the LHC

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With the goal of increasing the precision of NLO QCD prediction for pp -> ttA in the dilepton decay channel we study cross section ratios. Our analysis is based on fully realistic matrix elements including off-shell effects and interferences between resonance and continuum contributions. Focusing on the LHC at 13 TeV we present numerical results for inclusive and differential ratios and a detailed study of theoretical uncertainties stemming from renormalization/factorization scales as well as the impact of the parton distribution functions.

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Parallel Session Higgs+Top+EW / 418

Precision electroweak and V+jets results from ATLAS

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Subject:

Parallel Session Higgs+Top+EW / 417

Precision electroweak results from CMS

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Subject:

Parallel Session QCD+HF / 398

Precision measurements of jet substructure and fragmentation in ATLAS

QCD+EW+Top Physics+Heavy Ions / 332

Progress in State-of-the-Art Matched Resummation/pQCD Calculations

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The Higgs Boson / **331**

Progress on SM Higgs precision calculations

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Subject:

Parallel Session QCD+HF / **399**

QCD highlights from ALICE

Parallel Session QCD+HF / **397**

QCD studies in ATLAS and CMS

Parallel Session Astro+Cosmo / **340**

Radio Neutrino Astronomy

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The Higgs Boson / **324**

Rare Higgs Decays and Production Modes

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Heavy Flavour Physics / **317**

Rare decays

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Parallel Session Higgs+Top+EW / 435

Rare top quark production in CMS

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Parallel Session QCD+HF / 389

Rare, radiative, and electroweak penguin decays of heavy flavour hadrons at LHCb

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QCD+EW+Top Physics+Heavy Ions / 328

Recent Precision W/Z Measurements at the LHC

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Beyond the Standard Model / Dark Matter / 313

Recent Results and Prospects for Direct Detection Dark Matter Experiments

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Beyond the Standard Model / Dark Matter / 314

Recent Results and Prospects for Indirect Dark Matter Detection

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Parallel Session Astro+Cosmo / 348

Recent Results from ANTARES

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QCD+EW+Top Physics+Heavy Ions / 329

Recent VBS and VBF Measurements at the LHC

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Parallel Session Astro+Cosmo / 349

Recent highlights from VERITAS

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Parallel Session BSM+DM / 382

Recent results from EDELWEISS Dark Matter searches

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The EDELWEISS collaboration is performing direct searches for light Dark Matter particles using cryogenic germanium detectors equipped with a charge and thermal signal readout. This versatile and highly performing technology opens new possibilities for searches for signals involving either electrons or nuclear recoils. This is attested to by results on Axion-Like Particles in the keV range, and by the attainment of the first sub-GeV spin-independent dark matter limit based on a germanium target. The search has been extended to Strongly Interacting Particles (SIMP) down to 45 MeV by

exploiting the Migdal effect. New results on SIMPs with spin-dependent interactions will also be presented.

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Recent results from EDELWEISS Dark Matter searches **Subject**:

BSM+DM

Parallel Session Higgs+Top+EW / 452

Recent results on W/Z/top physics in LHCb

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Parallel Session QCD+HF / 405

Results from proton-lead and fixed-target collisions at LHCb

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Abstract Title:

Subject:

Parallel Session Neutrinos / 409

Results of NOvA

Parallel Session Neutrinos / 410

Results of PROSPECT

Parallel Session Neutrinos / **376**

Search for eV Sterile Neutrinos – The STEREO Experiment

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In recent years, major milestones in neutrino physics were accomplished at nuclear reactors: the smallest neutrino mixing angle θ_{13} was determined with high precision and the emitted anti-neutrino spectrum was measured at unprecedented resolution. However, two anomalies, the first one related to the absolute flux and the second one to the spectral shape, have yet to be solved. The flux anomaly is known as the Reactor Antineutrino Anomaly (RAA) and could be caused by the existence of a light sterile neutrino eigenstate participating in the neutrino oscillation phenomenon. The RAA is best explained by an oscillation with parameters $\sin^2(2\theta_{ee}) = 0.14$ and $\Delta m^2_{41} = 2.4$ eV^2.

The STEREO experiment was built to probe this parameter region. It is one of the first running experiments built to search for eV sterile neutrinos and takes data since end of 2016 at ILL Grenoble (France). At a short baseline of 10 metres, it measures the anti-neutrino flux and spectrum emitted by a compact research reactor. The segmentation of the detector in six cells allows for independent measurements of the neutrino spectrum at multiple baselines. An active-sterile flavour oscillation could be unambiguously detected, as it distorts the spectral shape of each cell's measurement differently. In 2018, STEREO was able to exclude significant part of the parameter space with its first data set of 66 (138) days reactor-on (off) data.

In this contribution, an overview on the STEREO experiment will be given. Furthermore, updated results with the new increased dataset of 185 (233) days of reactor-on (off) will be presented.

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Search for eV Sterile Neutrinos – The STEREO Experiment **Subject**:

Neutrinos

Parallel Session Neutrinos / **352**

Search for neutrinoless double beta decay with GERDA

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The GERDA experiment searches for the neutrinoless double beta decay ($0\nu\beta\beta$) of ^{76}Ge. It uses HPGe detectors enriched in the isotope ^{76}Ge, which are directly immersed into liquid argon (LAr). In Phase II, the radio-pure cryogenic liquid acts not only as cooling medium for the detectors and passive shielding but also as active shielding. Due to the active veto system detecting LAr scintillation light, the superior energy resolution and an improved background recognition, already the initial release of Phase II showed a background rate in the energy region of interest (ROI), after pulse shape discrimination and liquid argon veto cuts, in the range of a few counts/(ROI·ton·yr). This made GERDA the first $0\nu\beta\beta$ experiment being background free up to its design exposure of 100 kg·yr.

With the latest data release in mid 2018, comprising a total exposure of 82.4 kg·yr, GERDA remained in the background free regime. It is the first experiment to surpass a median sensitivity on the half-life of 10^{26} yr for $0\nu\beta\beta$ decay. No signal has been observed and a lower limit of $0.9 \cdot 10^{26}$ yr (90 % C.L.) has been derived. Meanwhile the experiment has been upgraded by deploying also a new type of germanium detector and by improving the LAr instrumentation. In this talk we will present the basic concept of the GERDA design and the present physics results. Moreover, we will focus on the background contributions at $Q_{\beta\beta}$. Results on the performance of the upgraded experimental setup will be discussed.

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Search for neutrinoless double beta decay with GERDA **Subject**:

Neutrinos

Beyond the Standard Model / Dark Matter / 327

Searches for Dark Matter at the LHC

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Parallel Session Higgs+Top+EW / 427

Searches for an extended Higgs sector in CMS

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Beyond the Standard Model / Dark Matter / 326

Searches in the Long-Lived Particle and Dark Sectors

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Parallel Session BSM+DM / 440

Searches with boosted objects in ATLAS and CMS

Parallel Session Astro+Cosmo / 361

South Pole Telescope Status and prospects

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Parallel Session BSM+DM / 443

Specific ATLAS BSM talk (SUSY or exotica)

Parallel Session BSM+DM / 441

Specific ATLAS BSM talk (exotica)

Parallel Session BSM+DM / 446

Specific ATLAS BSM talk (SUSY)

Parallel Session BSM+DM / 442

Specific CMS BSM talk (exotica)

Parallel Session BSM+DM / 444

Specific CMS BSM talk (SUSY or exotica)

Parallel Session BSM+DM / 447

Specific CMS BSM talk (SUSY)

Beyond the Standard Model / Dark Matter / 336

Status of BSM searches after LHC Run-2

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Neutrino Physics / 319

Status of Neutrino Parameters and Future Prospects

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Neutrino Physics / 453

Sterile neutrino searches and scenarios as dark matter

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Sterile neutrino searches and scenarios as dark matter

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Parallel Session QCD+HF / 402

Subtraction methods at NNLO

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Highlights / 302

Ten Years of LHC - Highlights, Challenges and Opportunities

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Parallel Session Neutrinos / **408**

Testing New Physics Explanations of MiniBooNE Anomaly at Neutrino Scattering Experiments

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354

The Higgs and cosmology

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I review implications of the Higgs boson properties for dark matter, inflation and baryogenesis.

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The Higgs and cosmology **Subject**:

BSM+DM

Parallel Session Neutrinos / **454**

The NEXT experiment for neutrinoless double beta decay searches

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The NEXT experiment for neutrinoless double beta decay searches

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The Neutrino Experiment with a Xenon TPC (NEXT) will search for the neutrinoless double beta decay of Xe-136 using a high-pressure xenon gas time projection chamber. This detector technology offers several key advantages, including excellent energy resolution and powerful event classification based on track topology.
After reviewing the fundamentals of the experiment, this talk will highlight recent results from the NEXT-White prototype, which has been acquiring data at the Laboratorio Subterráneo de Canfranc (LSC), in Spain, for the last 3 years, showing excellent performance. We will discuss as well the status and prospects of the upcoming NEXT-100, expected to start its operation in early 2020.

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The NEXT experiment for neutrinoless double beta decay searches **Subject**:

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Parallel Session Astro+Cosmo / **358**

The Search for Inflationary B-modes: Latest Results from BICEP/Keck

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The BICEP/Keck series of experiments are small aperture refracting telescopes designed to measure the polarization pattern of the Cosmic Microwave Background at degree angular scales. The latest BK15 results use measurements at 95, 150 and 220GHz, in conjunction with additional bands from WMAP and Planck, to constrain the foreground signal and set the limit r<0.07 (95% confidence). I will describe the current intruments, data and analysis, and also the major BICEP Array upgrade which is projected to reach sensitivity of $\sigma(r) \sim 0.003$ within the next five years.

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The Search for Inflationary B-modes: Latest Results from BICEP/Keck **Subject**:

Astro/Cosmo

Parallel Session Astro+Cosmo / **363**

The Simons Observatory: status and prospects

Highlights / **301**

The Visions of G. Smoot

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Highlights / **436**

The quantized black hole as a theoretical laboratory

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Einstein's theory of General Relativity gives a description of the gravitational force that has been checked accurately for large systems such as planets and stars. However, it should also be valid at the scale of single atoms and molecules. A serious complication however is that these tiny particles behave in accordance with the laws of quantum mechanics, and while these laws are understood when applied to electricity and magnetism, the gravitational force here seems to be mysterious. To investigate the situation further, theoreticians consider the most extreme configurations of space and time that follow from General Relativity: black holes. We have the Schroedinger equation for the elementary particles. What is the Schroedinger equation for a black hole?

Space and time are dynamical entities; do they follow wave equations?

We cannot do experiments with real black holes since all known black holes are large and very far away, and so we are forced to do these experiments in our imagination. But we can investigate the internal logic when we attempt at writing universal equations, but these give rise to fierce discussions.

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Astro/Cosmo

Highlights / **303**

The quantized black hole as a theoretical laboratory

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Einstein's theory of General Relativity gives a description of the gravitational force that has been checked accurately for large systems such as planets and stars. However, it should also be valid at the scale of single atoms and molecules. A serious complication however is that these tiny particles behave in accordance with the laws of quantum mechanics, and while these laws are understood when applied to electricity and magnetism, the gravitational force here seems to be mysterious. To investigate the situation further, theoreticians consider the most extreme configurations of space and time that follow from General Relativity: black holes. We have the Schroedinger equation for the elementary particles. What is the Schroedinger equation for a black hole?

Space and time are dynamical entities; do they follow wave equations?

We cannot do experiments with real black holes since all known black holes are large and very far away, and so we are forced to do these experiments in our imagination. But we can investigate the internal logic when we attempt at writing universal equations, but these give rise to fierce discussions.

Parallel Session BSM+DM / 450

The search for Dark Matter with the IceCube Neutrino Telescope

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Parallel Session Astro+Cosmo / 350

The transient sky at very-high energies: the MAGIC observations in the multi-messenger context

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Neutrino Physics / 320

Theoretical Models for the Neutrino Mass and Mixing Pattern

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Heavy Flavour Physics / 318

Theoretical Point of View

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Parallel Session Higgs+Top+EW / 419

Theoretical uncertainties for the W-boson mass

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Parallel Session Higgs+Top+EW / 369

Theoretical uncertainties in the W-boson mass determination at hadron colliders

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The high-precision measurement of the W-boson mass (MW) offers the possibility of a stringent test of the Standard Model of the electroweak and strong interactions. The uncertainty of the current world average for MW is 0.2 per mille and the ATLAS and CMS collaborations at CERN are planning to measure MW reaching a final error of 15 MeV or eventually 10 MeV: such a precision requires a careful assessment of the theoretical systematics affecting the W-boson mass measurement at hadron colliders. The main sources of theoretical uncertainties are discussed focusing in particular on the electroweak and mixed QCD-electroweak effects.

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EW+Top+Higgs

Parallel Session Higgs+Top+EW / 428

Top mass measurements in ATLAS and CMS

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Parallel Session Higgs+Top+EW / 431

Top-quark cross-sections and properties in CMS

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Parallel Session Higgs+Top+EW / 430

Top-quark modelling

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Parallel Session Higgs+Top+EW / 429

Top-quark property measurements in ATLAS and CMS

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Parallel Session Higgs+Top+EW / 434

Total and differential cross-sections for ttbar and ttbar+gamma in ATLAS

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Parallel Session QCD+HF / 400

Vector Boson plus jet at forward rapidities

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Subject:

Parallel Session Higgs+Top+EW / 415

Vector-boson fusion results from CMS

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Parallel Session Higgs+Top+EW / 414

Vector-boson scattering results from ATLAS

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Parallel Session Astro+Cosmo / 384

What will the largest neutrino telescopes tell us about solar flares?

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Parallel Session Astro+Cosmo / 375

What will the largest neutrino telescopes tell us about solar flares?

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The main motivation to search for solar flare neutrinos comes from their hadronic origin. Being inherent products of high-energy proton collisions with the chromosphere, they represent a direct probe of the protons accelerated towards the Chromosphere. Using a multi-messenger approach combining neutrinos and gamma rays, it is therefore possible to constrain the proton acceleration taking place in solar flares, especially the spectral index of the accelerated flux and its shape.

We present the results of the first search for GeV neutrinos emitted during solar flares carried out with the IceCube Neutrino Observatory. Originally designed to detect 10 GeV - TeV neutrinos, a new approach allowing to strongly lower the energy threshold of IceCube will be presented. We compare the results with theoretical estimates of the corresponding flux. We then discuss the prospects for the next solar flare cycles, for which KM3NeT, being currently deployed in the Mediterranean Sea, will be able to join IceCube in constraining/observing the solar flare neutrino flux. We present several analyses that can be performed using the KM3NeT detector in view of studying this flux. As a conclusion, we sketch the interest of combining KM3NeT and IceCube data in a solar flare neutrino search.

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What will the largest neutrino telescopes tell us about solar flares? **Subject**:

Astro/Cosmo

Parallel Session QCD+HF / 394

XYZ particles at BESIII

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Parallel Session QCD+HF / 371

XYZ particles at BESIII

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With its unique data samples at energies of 3.8–4.6 GeV, the BESIII experiment made a significant contribution to the study of charmonium and charmonium-like states, i.e., the XYZ states. A large number of Z states has been discovered in charmonium and open-charm decays. Isospin triplet has been established for all the decays, while the quantum number of them has been measured in a couple of channels. New Y states have been observed in several decays with some puzzling behavior, while there is a hint of a strong connection between X,Y states and radiative decays.

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